Online Appendix for "Salience and Taxation with Imperfect Competition"

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Proofs

Proof of Lemma 1

Proof. Note that

$$\begin{aligned}
\epsilon_{Dt} &= \frac{dD(p(t),t)}{dt}\frac{p+t}{q(t)} \\
&= \frac{p+t}{q(t)}\int \frac{\partial D_i}{\partial p}(p(t),t)\left(\frac{dp}{dt}+\theta_i\right)di \\
&= \frac{p+t}{q(t)}\left((\rho-1)\frac{\partial D}{\partial p}+\int \frac{\partial D_i}{\partial p}(p(t),t)\theta_i di\right) \\
&= \frac{p+t}{q(t)}\left((\rho-1+\mathbb{E}(\theta_i))\frac{\partial D}{\partial p}+Cov\left(\theta_i,\frac{\partial D_i(p,t)}{\partial p}\right)\right) \\
&= -(\mathbb{E}(\theta_i)+\rho-1)\epsilon_D+\frac{p+t}{q(t)}Cov\left(\theta_i,\frac{\partial D_i(p,t)}{\partial p}\right)
\end{aligned}$$

Finally, under assumption 1 $\frac{\partial D_i}{\partial p}(p(t),t)$ is constant in i and so $Cov\left(\theta_i, \frac{\partial D_i(p,t)}{\partial p}\right)=0$ □

Proof of Proposition 1

Proof. Let the market be perfect competition. Consumer surplus can be expressed as

$$CS_i = \int_0^{q_i} wtp_i(s)ds - (p+t)q_i$$

Given $\rho \equiv 1 + \frac{dp}{dt}$, we have

$$\begin{aligned}\frac{dCS_i}{dt} &= wtp_i(q_i)\frac{dq_i}{dt} - \rho q_i - (p+t)\frac{dq_i}{dt} \\ &= (p+\theta_i t)\frac{dq_i}{dt} - \rho q_i - (p+t)\frac{dq_i}{dt} \\ &= -\rho q_i - (1-\theta_i)t\frac{dq_i}{dt}\end{aligned}$$

where the second equality follows from the fact that $wtp_i(q_i) = p + \theta_i t$, then

$$\begin{aligned}\frac{dCS}{dt} &= \int \frac{dCS_i}{dt} di \\ &= -\rho\mathbb{E}(q_i) - t\mathbb{E}\left((1-\theta_i)\frac{dq_i}{dt}\right) \\ &= -\rho q - (1-\mathbb{E}(\theta_i))t\frac{dq}{dt} + tCov\left(\theta_i, \frac{dq_i}{dt}\right)\end{aligned}$$

For the tax revenue, we have

$$\frac{dR}{dt} = q + t\frac{dq}{dt}$$

For producer surplus, we have

$$\frac{dPS}{dt} = -(1-\rho)q$$

Note that

$$\begin{aligned}\frac{dq}{dt} &= \int \frac{dq_i}{dt} di \\ &= \int \frac{\partial D_i}{\partial p}\left(\frac{dp}{dt} + \theta_i\right) di \\ &= \mathbb{E}\left(\frac{\partial D_i}{\partial p}\right) * (\rho - 1 + \mathbb{E}(\theta_i)) + Cov\left(\theta_i, \frac{\partial D_i}{\partial p}\right)\end{aligned}$$

Then we have

$$\begin{aligned}
\rho &= \frac{dp}{dt} + 1 \\
&= 1 - \left(1 - \frac{1}{1 + \frac{\epsilon_D}{\epsilon_S}\frac{p}{p+t}}\right)\left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial D_i}{\partial p}\right)}{\frac{\partial D}{\partial p}}\right) \\
&= 1 - (1-\omega)\left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial D_i}{\partial p}\right)}{\frac{\partial D}{\partial p}}\right)
\end{aligned}$$

where $\omega = \frac{1}{1+\frac{\epsilon_D}{\epsilon_S}\frac{p}{p+t}}$

Using Lemma 1, we have

$$\begin{aligned}
I &= \frac{-\rho q - (1-\mathbb{E}(\theta_i))t\frac{dq}{dt} + tCov\left(\theta_i, \frac{dq_i}{dt}\right)}{-(1-\rho)q} \\
&= \frac{\rho}{1-\rho} + \frac{1-\mathbb{E}(\theta_i)}{1-\rho}\frac{t}{p+t}\epsilon_{Dt} - \frac{t}{q(1-\rho)}Cov\left(\theta_i, \frac{dq_i}{dt}\right)
\end{aligned}$$

Finally, the marginal excess burden of a unit tax is calculated by summing up the incidence on consumers, producers, and government. □

Proof of Proposition 2

Proof. Let the firm be a monopoly in the market. The incidence of a tax on consumers is the same as in the perfect competitive market, since the incidence does not depend on the firm's behavior. Similarly, the incidence on the government is the same as in the perfect competitive market.

Using Lerner's rule, we have in monopoly that $p - mc(q) = -mwtp(q)q$. The incidence on the producer is then

$$\begin{aligned}\frac{dPS}{dt} &= \frac{dp}{dt}q + [p - mc(q)]\frac{dq}{dt} \\ &= (\rho - 1)q - mwtp(q)q\frac{dq}{dt} \\ &= (\rho - 1)q - q\frac{\int \frac{dq_i}{dt}di}{\frac{\partial D}{\partial p}} \\ &= (\rho - 1)q - q\frac{\int \frac{\partial D_i}{\partial p}\left(\frac{dp}{dt} + \theta_i\right)di}{\frac{\partial D}{\partial p}} \\ &= (\rho - 1)q - q\left[\frac{dp}{dt} + \frac{\int \theta_i \frac{\partial D_i}{\partial p}di}{\frac{\partial D}{\partial p}}\right] \\ &= -q\left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial D_i}{\partial p}\right)}{\frac{\partial D}{\partial p}}\right)\end{aligned}$$

Recall thar marginal surplus is $ms(q) = -mwtp(q)q$. Furthermore, define $MS(q,t) = -\frac{q}{\frac{\partial D}{\partial p}(p(t),t)} = \frac{ms(q)}{mwtp(q(t)) * \frac{\partial D}{\partial p}(p(t),t)}$, then $MS(q,0) = ms(q)$. Let $MS_t = \frac{\partial MS}{\partial t}$, and let $\epsilon_{ms} = \frac{MS}{MS_q q}$, we have

$$p - mc(q) = MS(q,t)$$

Therefore

$$\begin{aligned}\frac{dp}{dt} &= (MS_q(q,t) + mc'(q))\frac{dq}{dt} + MS_t \\ &= (MS_q(q,t) + mc'(q))\left(\frac{\partial D}{\partial p}\left(\frac{dp}{dt} + \mathbb{E}(\theta_i)\right) + Cov\left(\theta_i, \frac{\partial D_i}{\partial p}\right)\right) + MS_t\end{aligned}$$

Then we have

$$\begin{aligned}
\rho &= \frac{dp}{dt} + 1 \\
&= 1 + \frac{(ms'(q)+mc'(q))\left(\frac{\partial D}{\partial p}\mathbb{E}(\theta_i) + Cov\left(\theta_i, \frac{\partial D_i}{\partial p}\right)\right) + MS_t}{1 - \frac{\partial D}{\partial p}(ms'(q)+mc'(q))} \\
&= 1 + \left(\frac{1}{1 - \frac{\partial D}{\partial p}(ms'(q)+mc'(q))} - 1\right)\left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial D_i}{\partial p}\right)}{\frac{\partial D}{\partial p}}\right) + \frac{MS_t}{1 - \frac{\partial D}{\partial p}(ms'(q)+mc'(q))} \\
&= 1 - \left(1 - \frac{1}{1 + \frac{\epsilon_D \frac{p}{p+t} - 1}{\epsilon_S} + \frac{1}{\epsilon_{ms}}}\right)\left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial D_i}{\partial p}\right)}{\frac{\partial D}{\partial p}}\right) + \frac{MS_t}{1 - \frac{\partial D}{\partial p}(ms'(q)+mc'(q))} \\
&= 1 - (1-\omega)\left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial D_i}{\partial p}\right)}{\frac{\partial D}{\partial p}}\right) + \omega MS_t
\end{aligned}$$

where $\omega = \frac{1}{1 + \frac{\epsilon_D \frac{p}{p+t} - 1}{\epsilon_S} + \frac{1}{\epsilon_{ms}}}$.

The incidence of the tax is then:

$$\begin{aligned}
I &= \frac{-\rho q - (1 - \mathbb{E}(\theta_i))t\frac{dq}{dt} + tCov\left(\theta_i, \frac{dq_i}{dt}\right)}{-q * \left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial D_i}{\partial p}\right)}{\frac{\partial D}{\partial p}}\right)} \\
&= \frac{\epsilon_D}{\frac{p+t}{q}\mathbb{E}\left(\theta_i \frac{\partial D_i}{\partial p}\right)}\left(\rho + (1 - \mathbb{E}(\theta_i))\frac{t}{p+t}\epsilon_{Dt} - \frac{t}{q}Cov\left(\theta_i(p,t), \frac{dq_i}{dt}\right)\right)
\end{aligned}$$

The marginal excess burden of the tax is calculated by summing up the incidence on consumers, producers, and government. □

Derivation of Marginal Surplus Remark

Let $MS(q,t) = \frac{ms(q)}{mwtp(q(t)) * \frac{\partial D}{\partial p}(p(t),t)}$, then $MS(q,0) = ms(q)$, and $MS(q(t),t) = \frac{-mwtp(q(t))q(t)}{mwtp(q(t)) * \frac{\partial D}{\partial p}(p(t),t)} = -\frac{q(t)}{\frac{\partial D}{\partial p}(p(t),t)}$. If $MS_t = \frac{\partial MS}{\partial t}$ then:

$$
\begin{aligned}
MS_t &= \frac{-ms(q)}{\left(mwtp(q(t)) * \frac{\partial D}{\partial p}(p(t),t)\right)^2}\left(wtp''(q(t))q'(t) * \frac{\partial D}{\partial p}(p(t),t) + wtp'(q(t)) * \frac{\partial}{\partial t}\left(\frac{\partial D}{\partial p}(p(t),t)\right)\right) \\
&= \frac{-ms(q)}{\left(mwtp(q(t)) * \frac{\partial D}{\partial p}(p(t),t)\right)^2}\left(wtp''(q(t))q'(t) * \frac{\partial D}{\partial p}(p(t),t) + wtp'(q(t)) * \int \frac{\partial}{\partial t}\left(\frac{\partial D_i}{\partial p}(p(t)+\theta_i t, 0)\right) di\right) \\
&= \frac{-ms(q)}{\left(mwtp(q(t)) * \frac{\partial D}{\partial p}(p(t),t)\right)^2} * \\
&\left(wtp''(q(t))q'(t) * \frac{\partial D}{\partial p}(p(t),t) + wtp'(q(t)) * \int \frac{\partial^2 D_i}{\partial p^2}(p(t)+\theta_i t, 0) * \left(\frac{dp}{dt} + \theta_i\right) di\right) \\
&= \frac{-q}{mwtp(q)\left(\frac{\partial D}{\partial p}\right)^2}\left(wtp''(q)\frac{\partial D}{\partial p}\frac{dq}{dt} + mwtp(q)\left[\frac{dp}{dt}\int \frac{\partial^2 D_i}{\partial p^2} di + \int \left(\frac{\partial^2 D_i}{\partial p^2} * \theta_i\right) di\right]\right) \\
&= \frac{-q}{mwtp(q)\left(\frac{\partial D}{\partial p}\right)^2}\left(wtp''(q)\frac{\partial D}{\partial p}\frac{dq}{dt} + mwtp(q)\left[\frac{\partial^2 D}{\partial p^2}\left(\frac{dp}{dt} + \bar{\theta}\right) + Cov\left(\frac{\partial^2 D_i}{\partial p^2}, \theta_i\right)\right]\right) \\
&\approx \frac{-q}{\left(\frac{\partial D}{\partial p}\right)^2} Cov\left(\frac{\partial^2 D_i}{\partial p^2}, \theta_i\right)
\end{aligned}
$$

Note that under Assumption 1 the second derivatives are 0 and so $MS_t = 0$. Also for the model with fixed θ it is easy to show that $wtp' = \left(\frac{\partial D}{\partial p}\right)^{-1}$ implies $wtp''(q)\frac{dq}{dt} = -\frac{mwtp(q)}{\frac{\partial D}{\partial p}}\frac{\partial^2 D}{\partial p^2}\left(\frac{dp}{dt} + \bar{\theta}\right)$ so $MS_t = 0$.

Proof of Proposition 3

Proof. Let the market be symmetric imperfect competition with J products $j = 1, \ldots, J$ and the market conduct parameter $\nu_p = \frac{\partial p_k}{\partial p_j}$ $(k \neq j)$.

$$
CS_i = \int_0^{Q_i} wtp_i(s)ds - (p+t)Q_i
$$

Given $\rho \equiv 1 + \frac{dp}{dt}$, we have

$$
\begin{aligned}
\frac{dCS_i}{dt} &= wtp_i(Q_i)\frac{dQ_i(p(t),t)}{dt} - \rho Q_i - (p+t)\frac{dQ_i(p(t),t)}{dt} \\
&= (p+\theta_i t)\frac{dQ_i(p(t),t)}{dt} - \rho Q_i - (p+t)\frac{dQ_i(p(t),t)}{dt} \\
&= -\rho Q_i - (1-\theta_i)t\frac{dQ_i(p(t),t)}{dt}
\end{aligned}
$$

where the second equality follows from the fact that $wtp_i(Q_i) = p + \theta_i(p,t)t$, then

$$
\begin{aligned}
\frac{dCS}{dt} &= \int \frac{dCS_i}{dt} di \\
&= -\rho \mathbb{E}(Q_i) - t\mathbb{E}\left((1-\theta_i) \frac{dQ_i(p(t),t)}{dt} \right) \\
&= -\rho Q - (1-\mathbb{E}(\theta_i)) t \frac{dQ(p(t),t)}{dt} + tCov\left(\theta_i, \frac{dQ_i(p(t),t)}{dt} \right)
\end{aligned}
$$

For the tax revenue, we have

$$
\frac{dR}{dt} = Q + t\frac{dQ(p(t),t)}{dt}
$$

For producer surplus, taking the derivative of $PS = pQ - Jc(q)$ with respect to t, we have

$$
\begin{aligned}
\frac{dPS}{dt} &= (\rho-1)Q + J(p - mc(q))\frac{dq}{dt} \\
&= (\rho-1)Q + \frac{\nu_q}{J\epsilon_D} \frac{dQ(p(t),t)}{dt} p \\
&= (\rho-1)Q - \frac{\nu_q}{J} Q \frac{dQ(p(t),t)}{dt} \frac{1}{\frac{\partial Q}{\partial p}} \\
&= (\rho-1)Q - \frac{\nu_q}{J} Q \frac{\int \frac{dQ_i(p(t),t)}{dt} di}{\frac{\partial Q}{\partial p}} \\
&= (\rho-1)Q - \frac{\nu_q}{J} Q \frac{\int \frac{\partial Q_i}{\partial p} \left(\frac{dp}{dt} + \theta_i \right) di}{\frac{\partial Q}{\partial p}} \\
&= (\rho-1)Q - \frac{\nu_q}{J} Q \left[\frac{dp}{dt} + \frac{\int \theta_i \frac{\partial Q_i}{\partial p} di}{\frac{\partial Q}{\partial p}} \right] \\
&= -\left(1 - \frac{\nu_q}{J}\right) [Q(1-\rho)] - \frac{\nu_q}{J} \left[Q \left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial Q_i}{\partial p}\right)}{\frac{\partial Q}{\partial p}} \right) \right]
\end{aligned}
$$

The second equality comes from the Lerner condition $\frac{p-mc(q)}{p} = \frac{\nu_q}{J\epsilon_D}$, and the fifth equation comes from $\frac{dQ_i(p(t),t)}{dt} = \frac{\partial Q_i}{\partial p}\left(\frac{dp}{dt} + \theta_i\right)$.

Also note that

$$
\begin{aligned}
\frac{dQ(p(t),t)}{dt} &= \int \frac{dQ_i(p(t),t)}{dt} di \\
&= \int \frac{\partial Q_i}{\partial p} \left(\frac{dp}{dt} + \theta_i \right) di \\
&= \mathbb{E}\left(\frac{\partial Q_i}{\partial p} \right) (\rho - 1 + \mathbb{E}(\theta_i)) + Cov\left(\theta_i, \frac{\partial Q_i}{\partial p} \right)
\end{aligned}
$$

Now, to obtain the formula for pass-through, from Lerner condition we have

$$p - mc(Q) = -\frac{\nu_q}{J}\frac{Q}{\frac{\partial Q}{\partial p}}$$

Recall thar marginal surplus is $ms(Q) = -mwtp(Q)Q$. Furthermore, define $MS(Q,t) \equiv -\frac{Q}{\frac{\partial Q}{\partial p}(p(t),t)} = \frac{ms(Q)}{mwtp(Q(t)) * \frac{\partial Q}{\partial p}(p(t),t)}$, then $MS(Q,0) = ms(Q)$. Let $MS_t = \frac{\partial MS}{\partial t}$, and let $\epsilon_{ms} = \frac{MS}{MS_Q Q}$, we have

$$p - mc(Q) = \frac{\nu_q}{J} MS(Q,t)$$

Therefore

$$\begin{aligned}\frac{dp}{dt} &= \left(\frac{\nu_q}{J} MS_Q(Q,t) + mc'(Q)\right)\frac{dQ(p(t),t)}{dt} + \frac{\nu_q}{J} MS_t \\ &= \left(\frac{\nu_q}{J} MS_Q(Q,t) + mc'(Q)\right)\left(\frac{\partial Q}{\partial p}\left(\frac{dp}{dt} + \mathbb{E}(\theta_i)\right) + Cov\left(\theta_i, \frac{\partial Q_i}{\partial p}\right)\right) + \frac{\nu_q}{J} MS_t\end{aligned}$$

and

$$\frac{dp}{dt}\left[1 - \frac{\partial Q}{\partial p}\left(\frac{\nu_q}{J} MS_Q(Q,t) + mc'(Q)\right)\right] =$$
$$\left(\frac{\nu_q}{J} MS_Q(Q,t) + mc'(Q)\right)\left(\frac{\partial Q}{\partial p}\left(\mathbb{E}(\theta_i)\right) + Cov\left(\theta_i, \frac{\partial Q_i}{\partial p}\right)\right) + \frac{\nu_q}{J} MS_t$$

Then we have

$$
\begin{aligned}
\rho &= \frac{dp}{dt} + 1 \\
&= 1 + \frac{\left(\frac{\nu_q}{J} ms'(Q) + mc'(Q)\right)\left(\frac{\partial Q}{\partial p}\mathbb{E}(\theta_i) + Cov\left(\theta_i, \frac{\partial Q_i}{\partial p}\right)\right) + \frac{\nu_q}{J} MS_t}{1 - \frac{\partial Q}{\partial p}\left(\frac{\nu_q}{J} ms'(Q) + mc'(Q)\right)} \\
&= 1 + \left(\frac{1}{1 - \frac{\partial Q}{\partial p}\left(\frac{\nu_q}{J} ms'(Q) + mc'(Q)\right)} - 1\right)\left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial Q_i}{\partial p}\right)}{\frac{\partial Q}{\partial p}}\right) \\
&+ \frac{\frac{\nu_q}{J} MS_t}{1 - \frac{\partial Q}{\partial p}\left(\frac{\nu_q}{J} ms'(Q) + mc'(Q)\right)} \\
&= 1 - \left(1 - \frac{1}{1 + \frac{\epsilon_D - \frac{\nu_q}{J}}{\epsilon_S} + \frac{\frac{\nu_q}{J}}{\epsilon_{ms}}}\right)\left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial Q_i}{\partial p}\right)}{\frac{\partial Q}{\partial p}}\right) \\
&+ \frac{\frac{\nu_q}{J} MS_t}{1 - \frac{\partial Q}{\partial p}\left(\frac{\nu_q}{J} ms'(Q) + mc'(Q)\right)} \\
&= 1 - (1 - \omega)\left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial Q_i}{\partial p}\right)}{\frac{\partial Q}{\partial p}}\right) + \omega \frac{\nu_q}{J} MS_t
\end{aligned}
$$

where $\omega = \frac{1}{1 + \frac{\epsilon_D - \frac{\nu_q}{J}}{\epsilon_S} + \frac{\frac{\nu_q}{J}}{\epsilon_{ms}}}$.

The incidence of the tax is then:

$$
\begin{aligned}
I &= \frac{-\rho Q - (1 - \mathbb{E}(\theta_i)) t \frac{dQ}{dt} + tCov\left(\theta_i, \frac{dQ_i(p(t),t)}{dt}\right)}{-\left(1 - \frac{\nu_q}{J}\right)[Q(1-\rho)] - \frac{\nu_q}{J}\left[Q\left(\mathbb{E}(\theta_i) + \frac{Cov\left(\theta_i, \frac{\partial Q_i}{\partial p}\right)}{\frac{\partial Q}{\partial p}}\right)\right]} \\
&= \frac{\rho + (1 - \mathbb{E}(\theta_i)) \frac{t}{p+t}\epsilon_{Dt} - \frac{t}{Q} Cov\left(\theta_i, \frac{dQ_i(p(t),t)}{dt}\right)}{(1-\rho)\left(1 - \frac{\nu_q}{J}\right) + \frac{\nu_q}{J} \frac{\mathbb{E}\left(\theta_i \frac{\partial Q_i}{\partial p}\right)}{\mathbb{E}\left(\frac{\partial Q_i}{\partial p}\right)}}
\end{aligned}
$$

The marginal excess burden of the tax is calculated by summing up the incidence on consumers, producers, and government. □

Proof of Lemma 2

Proof. Observe

$$\begin{aligned}
\epsilon_{D\tau} &= \frac{dQ}{d\tau}\frac{p(1+\tau)+t}{Q} \\
&= -\epsilon_D * \left((1+\tau)\frac{dp}{d\tau}+p\right) \\
&= -\epsilon_D * \frac{p}{1+\tau}\left((1+\theta_\tau\tau)\left(\frac{1}{p}(1+\tau)\frac{\partial p}{\partial\tau}+1\right)+\theta_\tau-1\right) \\
&= -\epsilon_D * \frac{p}{1+\tau}\left((1+\theta_\tau\tau)\,\rho_\tau+\theta_\tau-1\right)
\end{aligned}$$

Solving for θ_τ we obtain:

$$\theta_\tau = \frac{(1-\rho_\tau)\,p\epsilon_D - \epsilon_{D\tau}(1+\tau)}{(1+\tau\rho_\tau)\,p\epsilon_D}$$

□

Proof of Proposition 4

Proof. Note that

$$\frac{dp}{d\tau} = \frac{1}{1+\theta_\tau\tau}(mwtp(q)\frac{dq}{d\tau} - p\theta_\tau) \tag{A1}$$

The first order condition with J symmetric products and conduct parameter ν_q is $p - mc(q) = -\frac{\nu_q}{J}\frac{mwtp(q)q}{1+\theta_\tau\tau}$, substitute $p = \frac{wtp(q)-\theta_t t}{1+\theta_\tau\tau}$ so we get $\frac{wtp(q)-\theta_t t}{1+\theta_\tau\tau} - mc(q) = -\frac{\nu_q}{J}\frac{mwtp(q)q}{1+\theta_\tau\tau}$ or $wtp(q) - \theta_t t - mc(q)\,(1+\theta_\tau\tau) = -\frac{\nu_q}{J}mwtp(q)q$. Taking thederivative with respect to τ, we have

$$mwtp(q)\frac{dq}{d\tau} - (1+\theta_\tau\tau)\,mc'(q)\frac{dq}{d\tau} - mc(q)\theta_\tau = -\frac{\nu_q}{J}\left(mwtp'(q)\frac{dq}{d\tau}q + mwtp(q)\frac{dq}{d\tau}\right)$$

Rearrange terms, we have

$$\left((1+\frac{\nu_q}{J})mwtp(q) - (1+\theta_\tau\tau)\,mc'(q) + \frac{\nu_q}{J}mwtp'(q)q\right)\frac{dq}{d\tau} = mc(q)\theta_\tau$$

And so

$$\frac{dq}{d\tau} = \frac{mc(q)\theta_\tau}{(1+\frac{\nu_q}{J})mwtp(q) - (1+\theta_\tau\tau)\, mc'(q) + \frac{\nu_q}{J}mwtp'(q)q}$$
$$= \frac{\frac{mc(q)\theta_\tau}{mwtp(q)}}{(1+\frac{\nu_q}{J}) - \frac{mc'(q)q}{mc(q)}\frac{mc(q)(1+\theta_\tau\tau)}{mwtp(q)q} + \frac{\nu_q}{J}\frac{mwtp'(q)}{mwtp(q)}q}$$

Thus,

$$\frac{dq}{d\tau} = \frac{\theta_\tau\frac{mc(q)}{mwtp(q)}}{1 + \frac{(1+\theta_\tau)\epsilon_D^* - \frac{\nu_q}{J}}{\epsilon_S} + \frac{\frac{\nu_q}{J}}{\epsilon_{ms}}}$$

Therefore,

$$\frac{dp}{d\tau} = \frac{\theta_\tau}{1+\theta_\tau\tau}\left(\frac{\frac{mc(q)}{p}}{1 + \frac{(1+\theta_\tau)\epsilon_D^* - \frac{\nu_q}{J}}{\epsilon_S} + \frac{\frac{\nu_q}{J}}{\epsilon_{ms}}} - 1\right)$$

And

$$\rho_\tau = \frac{\theta_\tau(1+\tau)}{1+\theta_\tau\tau}\left(\frac{\frac{mc(q)}{p}}{1 + \frac{(1+\theta_\tau)\epsilon_D^* - \frac{\nu_q}{J}}{\epsilon_S} + \frac{\frac{\nu_q}{J}}{\epsilon_{ms}}} - 1\right) + 1$$

Similarly, we have

$$\frac{dp}{dt} = \frac{1}{1+\theta_\tau\tau}(mwtp(q)\frac{dq}{dt} - \theta_t)$$

The first order condition of monopoly is $p - mc(q) = -\frac{\nu_q}{J}\frac{mwtp(q)q}{1+\theta_\tau\tau}$, or $wtp(q) - \theta_t t - mc(q)\,(1+\theta_\tau\tau) = -\frac{\nu_q}{J}mwtp(q)q$. Taking the derivative w.r.t t we get:

$$\left(mwtp(q) - mc'(q)\,(1+\theta_\tau\tau) + \frac{\nu_q}{J}mwtp'(q)q + \frac{\nu_q}{J}mwtp(q)\right)\frac{dq}{dt} = \theta_t$$

And so

$$\frac{dq}{dt} = \frac{\theta_t}{mwtp(q) - mc'(q)\,(1+\theta_\tau\tau) + \frac{\nu_q}{J}mwtp'(q)q + \frac{\nu_q}{J}mwtp(q)}$$
$$= \frac{\frac{\theta_t}{mwtp(q)}}{1 - \frac{mc'(q)q}{mc(q)}\frac{(1+\theta_\tau\tau)mc(q)}{mwtp(q)q} + \frac{\frac{\nu_q}{J}\left(mwtp'(q)q + mwtp(q)\right)}{mwtp(q)}}$$

Thus,

$$\frac{dq}{dt} = \frac{\frac{\theta_t}{mwtp(q)}}{1 + \frac{(1+\theta_\tau)\epsilon_D^* - \frac{\nu q}{J}}{\epsilon_S} + \frac{\frac{\nu q}{J}}{\epsilon_{ms}}}$$

Therefore,

$$\frac{dp}{dt} = \frac{\theta_t}{1 + \theta_\tau \tau} \left(\frac{1}{1 + \frac{(1+\theta_\tau)\epsilon_D^* - \frac{\nu q}{J}}{\epsilon_S} + \frac{\frac{\nu q}{J}}{\epsilon_{ms}}} - 1 \right)$$

consumer price is

$$\rho_t = 1 + \frac{dp}{dt}(1+\tau) = 1 + \frac{(1+\tau)\theta_t}{1 + \theta_\tau \tau} \left(\frac{1}{1 + \frac{(1+\theta_\tau)\epsilon_D^* - \frac{\nu q}{J}}{\epsilon_S} + \frac{\frac{\nu q}{J}}{\epsilon_{ms}}} - 1 \right)$$

□

Proof of Proposition 5

Proof. Denote $wtp = p(1 + \theta_\tau \tau) + \theta_t t$ the perceived price by the consumer and $\epsilon_D^* = \epsilon_D \frac{p}{p(1+\tau)+t}$. We have

$$\begin{aligned}
\frac{dCS}{d\tau} &= wtp(Q)\frac{dQ}{d\tau} - Q\frac{d(p(1+\tau)+t)}{d\tau} - (p(1+\tau)+t)\frac{dQ}{d\tau} \\
&= -Q\frac{d(p(1+\tau)+t)}{d\tau} - \frac{dQ}{d\tau}\Big((1-\theta_\tau)p\tau + (1-\theta_t)t\Big)
\end{aligned}$$

$$\begin{aligned}
\frac{dCS}{dt} &= wtp(Q)\frac{dQ}{dt} - Q\frac{d(p(1+\tau)+t)}{dt} - (p(1+\tau)+t)\frac{dQ}{dt} \\
&= -Q\frac{d(p(1+\tau)+t)}{dt} - \frac{dQ}{dt}\Big((1-\theta_\tau)p\tau + (1-\theta_t)t\Big)
\end{aligned}$$

$$\begin{aligned}
\frac{dPS}{d\tau} &= \frac{d\Big((p - mc(q))q\Big)}{d\tau} \\
&= \frac{dp}{d\tau}q + \Big(p - mc(q)\Big)\frac{dq}{d\tau}
\end{aligned}$$

$$\frac{dPS}{dt} = \frac{d\Big((p - mc(q))q\Big)}{dt}$$
$$= \frac{dp}{dt}q + \Big(p - mc(q)\Big)\frac{dq}{dt}$$

$$\frac{dR}{d\tau} = (\tau p + t)\frac{dQ}{d\tau} + Q\frac{d(\tau p + t)}{d\tau}$$
$$= (\tau p + t)\frac{dQ}{d\tau} - \frac{p\tau}{\epsilon_D}\frac{dQ}{d\tau} - (1+\tau)\frac{p}{\epsilon_D \rho_\tau}\frac{dQ}{d\tau}$$

$$\frac{dR}{dt} = (\tau p + t)\frac{dQ}{dt} + Q\frac{d(\tau p + t)}{dt}$$
$$= (\tau p + t)\frac{dQ}{dt} - \frac{p\tau}{\epsilon_D}\frac{dQ}{dt} - \frac{p}{\epsilon_D \rho_t}\frac{dQ}{d\tau}$$

Therefore, we have

$$\frac{dW}{d\tau} = \frac{dCS}{d\tau} + \frac{dPS}{d\tau} + \frac{dR}{d\tau}$$
$$= (p(1 + \theta_\tau \tau) + \theta_t t - mc(q))\,\frac{dQ}{d\tau}$$

$$\frac{dW}{dt} = (p(1 + \theta_\tau \tau) + \theta_t t - mc(q))\,\frac{dQ}{dt}$$

We also have

$$MC_\tau = -\frac{\frac{dW}{d\tau}}{\frac{dR}{d\tau}}$$
$$= -\frac{p(1 + \theta_\tau \tau) + \theta_t t - mc(q)}{(\tau p + t) - \frac{p\tau}{\epsilon_D} - (1+\tau)\frac{p}{\epsilon_D \rho_\tau}}$$
$$= \epsilon_D^* \frac{\frac{wtp - mc}{p}}{\frac{1 + \tau\rho_\tau}{(1 + \theta_\tau \tau)\rho_\tau + \theta_\tau - 1} - \epsilon_D^*(\tau + \frac{t}{p})}$$

And

$$
\begin{aligned}
MC_t &= -\frac{\frac{dW}{dt}}{\frac{dR}{dt}} \\
&= -\frac{p(1+\theta_\tau \tau) + \theta_t t - mc(q)}{(\tau p + t) - \frac{p\tau}{\epsilon_D} - \frac{p}{\epsilon_D \rho_t}} \\
&= \epsilon_D^* \frac{\frac{wtp - mc}{p}}{\frac{1+\tau\rho_\tau}{(1+\theta_\tau \tau)\rho_\tau + \theta_\tau - 1} - \epsilon_D^*(\tau + \frac{t}{p})}
\end{aligned}
$$

□

Derivations for ad valorem tax with heterogeneous consumers (used in calibrations)

For reference, we add the formulas to calculate the effect of increasing an ad-valorem tax on consumer surplus, and producer surplus in the presence of heterogenous consumers. We also derive the marginal excess burden and incidence formulas that we take to the data. Recall $\rho_\tau \equiv \frac{1}{p}\frac{\partial(p(1+\tau)+t)}{\partial \tau}$ and $D(p,t,\tau) = D(p(1+\theta_\tau \tau) + \theta_t t, 0, 0)$. Then

$$
\frac{dCS}{d\tau} = -pQ\rho_\tau - \frac{dQ}{d\tau}\Big((1-\mathbb{E}(\theta_\tau))p\tau + (1-\mathbb{E}(\theta_t))t\Big) + p\tau * Cov\left(\theta_{i\tau}, \frac{dQ_i}{dt}\right) + t * Cov\left(\theta_{it}, \frac{dQ_i}{dt}\right)
$$

$$
\frac{dPS}{d\tau} = -pQ * \left[\left(1 - \frac{\nu_q}{J}\right)\left(\frac{1}{1+\tau}\right)[1-\rho_\tau] + \frac{\nu_q}{J} * \left(1 - \frac{\tau}{1+\tau}(1-\rho_\tau)\right)\left[\mathbb{E}(\theta_{i\tau}) + \frac{Cov\left(\theta_{i\tau}, \frac{\partial Q_i}{\partial p}\right)}{\frac{\partial Q}{\partial p}}\right]\right]
$$

If only there is no unit tax, then $\theta_t = t = 0$ and so:

$$
\frac{dCS}{d\tau} = -pQ\rho_\tau - \frac{dQ}{d\tau}\Big((1-\mathbb{E}(\theta_\tau))p\tau\Big) + p\tau * Cov\left(\theta_{i\tau}, \frac{dQ_i}{dt}\right)
$$

$$
\frac{dPS}{d\tau} = -pQ * \left[\left(1 - \frac{\nu_q}{J}\right)\left(\frac{1}{1+\tau}\right)[1-\rho_\tau] + \frac{\nu_q}{J} * \left(1 - \frac{\tau}{1+\tau}(1-\rho_\tau)\right)\left[\mathbb{E}(\theta_{i\tau}) + \frac{Cov\left(\theta_{i\tau}, \frac{\partial Q_i}{\partial p}\right)}{\frac{\partial Q}{\partial p}}\right]\right]
$$

Furthermore, under assumption 1:

$$
\frac{dCS}{d\tau} = -pQ\rho_\tau - \frac{dQ}{d\tau}\Big((1-\mathbb{E}(\theta_{i\tau}))p\tau\Big) + p\tau * \frac{\partial Q}{\partial p} Var\left(\theta_{i\tau}\right)
$$

$$\frac{dPS}{d\tau} = -pQ * \left[\left(1 - \frac{\nu_q}{J}\right)\left(\frac{1}{1+\tau}\right)[1-\rho_\tau] + \frac{\nu_q}{J} * \left(1 - \frac{\tau}{1+\tau}(1-\rho_\tau)\right)[\mathbb{E}(\theta_{i\tau})]\right]$$

From where, we can derive a formula for incidence:

$$I = \frac{\rho_\tau + (1-\mathbb{E}(\theta_{i\tau}))\frac{\tau}{Q}\frac{dQ}{d\tau} - \frac{\tau}{Q} * \frac{\partial Q}{\partial p} Var(\theta_{i\tau})}{\left(1-\frac{\nu_q}{J}\right)\left(\frac{1}{1+\tau}\right)[1-\rho_\tau] + \frac{\nu_q}{J} * \left(1 - \frac{\tau}{1+\tau}(1-\rho_\tau)\right)\mathbb{E}(\theta_{i\tau})}$$

And so:

$$\frac{dW}{d\tau} = (p(1+\mathbb{E}(\theta_{i\tau})\tau) - mc(q))\frac{dQ}{d\tau} + p\tau * \frac{\partial Q}{\partial p} Var(\theta_{i\tau})$$

Finally, for the empirical implementation we use the follwing variations:

$$I = \frac{\rho_\tau + (1-\mathbb{E}(\theta_{i\tau}))\frac{\tau}{1+\tau}\frac{dlog(Q)}{dlog(1+\tau)} - \frac{\tau}{p} * \frac{\partial log(Q)}{\partial log(p)} Var(\theta_{i\tau})}{\left(1-\frac{\nu_q}{J}\right)\left(\frac{1}{1+\tau}\right)[1-\rho_\tau] + \frac{\nu_q}{J} * \left(1 - \frac{\tau}{1+\tau}(1-\rho_\tau)\right)\mathbb{E}(\theta_{i\tau})}$$

$$\frac{dW}{d\tau}\frac{1+\tau}{Q} = (p(1+\mathbb{E}(\theta_{i\tau})\tau) - mc(q))\frac{dlog(Q)}{dlog(1+\tau)} + \tau(1+\tau) * \frac{\partial log(Q)}{\partial log(p)} Var(\theta_{i\tau})$$

Online Appendix Table OA.1: Examples of Universal Product Codes (UPC)

UPC Description	**Module Description**	**Group Description**	**Department Description**	**Brand Description**	**Multi**	**Size**	**Units**
M&M PLN DK CH HDY-M HDY	CANDY-CHOCOLATE-SPECIAL	CANDY	DRY GROCERY	M&M MARS M&M PLAIN	1	12.6	OZ
M&M PLN CH/TY SHREK 2 HL	CANDY-CHOCOLATE-SPECIAL	CANDY	DRY GROCERY	M&M MARS M&M PLAIN	1	1.75	OZ
M&M PLN CH DSP STAR WARS	CANDY-CHOCOLATE-SPECIAL	CANDY	DRY GROCERY	M&M MARS M&M PLAIN	1	1.06	OZ
R SSY E-C MSE AP CHFN	COSMETICS-EYE SHADOWS	COSMETICS	HEALTH & BEAUTY CARE	REVLON STAR STYLE	1	0.17	OZ
R SSY E-S PWD SQN	COSMETICS-EYE SHADOWS	COSMETICS	HEALTH & BEAUTY CARE	REVLON STAR STYLE	1	0.05	OZ
AXE AR R TWIST	DEODORANTS - COLOGNE TYPE	DEODORANT	HEALTH & BEAUTY CARE	AXE	1	4	OZ
CTL BR EGGS A LG	EGGS-FRESH	EGGS	DAIRY	CTL BR	1	12	CT
CTL BR B-E JMB	EGGS-FRESH	EGGS	DAIRY	CTL BR	1	12	CT
COKE CLS R CL NB 6P	SOFT DRINKS - CARBONATED	CARBONATED BEVERAGES	DRY GROCERY	COCA-COLA CLASSIC R	6	8	OZ
COKE CLS R CL CN &	SOFT DRINKS - CARBONATED	CARBONATED BEVERAGES	DRY GROCERY	COCA-COLA CLASSIC R	1	12	OZ
GPC 2 UL L M F UT 85 P -.30	CIGARETTES	TOBACCO & ACCESSORIES	NON-FOOD GROCERY	GPC	1	20	CT
GPC 2 UL L M F UT 85 C -2.00	CIGARETTES	TOBACCO & ACCESSORIES	NON-FOOD GROCERY	GPC	10	20	CT

Source: Nielsen's Retail Scanner Data.

Online Appendix Table OA.2: Sources of sales tax exemption information

State	URLs	Type of Document
AL	http://revenue.alabama.gov/salestax/rules/810-6-5-.02.pdf	Laws and Regulations
AL	http://www.alabamaadministrativecode.state.al.us/docs/rev/810-6-3.pdf	Laws and Regulations
AL	http://revenue.alabama.gov/publications/business-taxes/sales/Sales_Tax--Sales_Tax_Brochure.pdf	Brochure
AZ	http://www.azleg.state.az.us/ArizonaRevisedStatutes.asp?Title=42	Laws and Regulations
AZ	http://www.azsos.gov/public_services/Title_15/15-05.htm	Laws and Regulations
AZ	https://www.azdor.gov/Portals/0/TPTRates/08012016RateTable.pdf	Table
AZ	https://www.azdor.gov/Portals/0/Brochure/575.pdf	Brochure
AR*	http://www.lexisnexis.com/hottopics/arcode/Default.asp	Laws and Regulations
AR*	http://www.dfa.arkansas.gov/offices/policyAndLegal/Documents/et2008_3.pdf	Laws and Regulations
AR*	http://www.dfa.arkansas.gov/offices/policyAndLegal/Documents/et2007_3.pdf	Laws and Regulations
AR*	http://www.dfa.arkansas.gov/offices/exciseTax/salesanduse/Documents/SalesTaxExemptionsFY2011.pdf	Brochure
CA	http://www.boe.ca.gov/lawguides/business/current/btlg/business-taxes-law-guide.html	Laws and Regulations
CA	https://www.boe.ca.gov/pdf/pub31.pdf	Brochure
CA	https://www.boe.ca.gov/pdf/pub27.pdf	Brochure
CA	https://www.boe.ca.gov/pdf/pub61.pdf	Brochure
CO	https://www.sos.state.co.us/CCR/GenerateRulePdf.do?ruleVersionId=4753	Laws and Regulations
CO	http://codes.findlaw.com/co/title-39-taxation/co-rev-st-sect-39-26-707.html	Laws and Regulations
CO	https://www.colorado.gov/pacific/sites/default/files/DR1002.pdf	Brochure
CO	https://www.colorado.gov/pacific/sites/default/files/Sales04.pdf	Brochure
CT	http://www.cga.ct.gov/2011/pub/chap219.htm	Laws and Regulations
CT	https://www.cga.ct.gov/2011/rpt/2011-R-0238.htm	Brochure
CT	http://www.ct.gov/drs/cwp/view.asp?A=1514&Q=563394	Brochure
CT	http://www.ct.gov/drs/cwp/view.asp?a=1511&q=267404	Brochure
DE	http://revenue.delaware.gov/services/current_bt/taxtips/grocery.pdf	Brochure
FL	http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&URL=0200-0299/0212/0212ContentsIndex.html	Laws and Regulations
FL	https://www.flrules.org/gateway/ChapterHome.asp?Chapter=12A-1	Laws and Regulations
FL	http://floridarevenue.com/Forms_library/current/dr46nt.pdf	Brochure
GA*	http://www.lexisnexis.com/hottopics/gacode/Default.asp	Laws and Regulations
GA*	http://garules.elaws.us/rule/560-12-2	Laws and Regulations
GA*	https://dor.georgia.gov/sites/dor.georgia.gov/files/related_files/document/LATP/Bulletin/2016%20List%20of%20Sales%20and%20Use%20Tax%20Exemptions.pdf	Brochure
ID	http://adminrules.idaho.gov/rules/current/35/0102.pdf	Laws and Regulations
ID	http://www.legislature.idaho.gov/idstat/Title63/T63CH36.htm	Laws and Regulations
ID	https://tax.idaho.gov/pubs/EBR00012_07-01-2001.pdf	Brochure
ID	https://tax.idaho.gov/pubs/EBR00016_03-23-2015.pdf	Brochure
IL	ftp://www.ilga.gov/JCAR/AdminCode/086/08600130sections.html	Laws and Regulations
IL	http://www.revenue.state.il.us/publications/Bulletins/2010/FY-2010-01.PDF	Brochure
IL	http://www.revenue.state.il.us/Publications/Pubs/Pub-117.pdf	Brochure
IN*	http://codes.findlaw.com/in/title-6-taxation/	Laws and Regulations
IN*	http://www.in.gov/legislative/iac/20080827-IR-045080658NRA.xml.pdf	Brochure
IA*	https://www.legis.iowa.gov/law/iowaCode/chapters?title=X	Laws and Regulations
IA*	http://law.justia.com/codes/iowa/2013/titlex/subtitle1/chapter423	Laws and Regulations
IA*	https://tax.iowa.gov/iowa-sales-tax-food	Brochure
KS*	http://kansasstatutes.lesterama.org/Chapter_79/	Laws and Regulations
KS*	http://rvpolicy.kdor.ks.gov/Pilots/Ntrntpil/IPILv1x0.NSF/$$ViewTemplate%20for%20Regulations%20Only?OpenForm	Laws and Regulations
KS*	http://www.ksrevenue.org/pdf/pub1510.pdf	Brochure
KY*	http://www.lrc.ky.gov/Statutes/chapter.aspx?id=37663	Laws and Regulations
KY*	http://www.lrc.ky.gov/kar/TITLE103.HTM	Laws and Regulations
KY*	http://revenue.ky.gov/Documents/AppendixN_CandyProduct91114.pdf	Brochure
KY*	http://revenue.ky.gov/News/Publications/Pages/Sales-Tax-Facts.aspx	Brochure
LA	http://www.legis.state.la.us/lss/lss.asp?folder=121	Laws and Regulations
LA	http://www.doa.louisiana.gov/osr/lac/61v01/61v01.doc	Laws and Regulations
LA	http://www.rev.state.la.us/Miscellaneous/FoodExemptionFlyer.pdf	Brochure
LA	http://revenue.louisiana.gov/Publications/R-1002(01-17)%20FINAL.pdf	Brochure

ME	http://www.mainelegislature.org/legis/statutes/36/title36ch0sec0.html	Laws and Regulations
ME	http://www.maine.gov/revenue/salesuse/Bull1220160101v2.pdf	Brochure
ME	http://www.maine.gov/revenue/salesuse/Bull2720160101v2.pdf	Brochure
MD	http://www.lexisnexis.com/hottopics/mdcode/	Laws and Regulations
MD	http://www.dsd.state.md.us/COMAR/title_search/Title_List.aspx	Laws and Regulations
MD	http://taxes.marylandtaxes.com/Resource_Library/Tax_Publications/Tax_Tips/Business_Tax_Tips/bustip5.pdf	Brochure
MA	https://malegislature.gov/Laws/GeneralLaws/PartI/TitleIX/Chapter64H	Laws and Regulations
MA	http://www.mass.gov/dor/individuals/taxpayer-help-and-resources/tax-guides/salesuse-tax-guide.html	Brochure
MI*	http://w3.lara.state.mi.us/orrsearch/948_2010-012TY_AdminCode.pdf	Laws and Regulations
MI*	https://www.michigan.gov/documents/treasury/RAB_2009-8_Food_for_Human_Consumption_Oct_09_299470_7.pdf	Brochure
MN*	https://www.revisor.mn.gov/statutes/?id=297A.67	Laws and Regulations
MN*	http://www.revenue.state.mn.us/businesses/sut/factsheets/FS102A.pdf	Brochure
MN*	http://www.revenue.state.mn.us/businesses/sut/factsheets/FS102B.pdf	Brochure
MN*	http://www.revenue.state.mn.us/businesses/sut/factsheets/FS102C.pdf	Brochure
MN*	http://www.revenue.state.mn.us/businesses/sut/factsheets/FS102D.pdf	Brochure
MN*	http://www.revenue.state.mn.us/businesses/sut/factsheets/FS117A.pdf	Brochure
MN*	http://www.revenue.state.mn.us/businesses/sut/factsheets/FS117F.pdf	Brochure
MS	http://www.lexisnexis.com/hottopics/mscode/	Laws and Regulations
MS	http://www.sos.ms.gov/admincodesearch/default.aspx	Laws and Regulations
MS	https://www.dor.ms.gov/Laws-Rules/Documents/Part%20IV%20Sales%20and%20Use%20Tax%2092216.pdf	Laws and Regulations
MS	http://www.dor.ms.gov/Business/Pages/Sales-Tax-Exemptions.aspx	Brochure
MO	http://www.moga.mo.gov/mostatutes/stathtml/14400000301.html	Laws and Regulations
MT	https://revenue.mt.gov/home/individuals/businesses_otherinformation#Sales%20Tax	Brochure
NE*	http://www.revenue.nebraska.gov/legal/regs/slstaxregs.html	Laws and Regulations
NE*	http://www.nebraskalegislature.gov/laws/browse-chapters.php?chapter=77	Laws and Regulations
NE*	http://www.revenue.nebraska.gov/info/6-432.pdf	Brochure
NE*	http://www.revenue.nebraska.gov/info/6-437.pdf	Brochure
NV*	http://www.leg.state.nv.us/NRS/NRS-372.html	Laws and Regulations
NV*	http://www.leg.state.nv.us/NAC/NAC-372.html	Laws and Regulations
NV*	https://tax.nv.gov/FAQs/Sales_Tax_Information___FAQ_s/	Brochure
NH	https://www.revenue.nh.gov/assistance/tax-overview.htm	Brochure
NJ*	http://law.justia.com/codes/new-jersey/2009/title-54/54-32b	Laws and Regulations
NJ*	http://www.state.nj.us/treasury/taxation/pdf/pubs/sales/su4.pdf	Brochure
NJ*	http://www.state.nj.us/treasury/taxation/pdf/ssutfood.pdf	Brochure
NM	http://www.nmcpr.state.nm.us/nmac/_title03/T03C002.htm	Laws and Regulations
NM	http://public.nmcompcomm.us/nmpublic/gateway.dll/?f=templates&fn=default.htm	Laws and Regulations
NM	http://realfile.tax.newmexico.gov/FYI-105%20-%20Gross%20Receipts%20&%20Compensating%20Taxes%20-%20An%20Overview.pdf	Brochure
NM	http://www.zillionforms.com/2016/P668403604.PDF	Brochure
NY	http://codes.findlaw.com/ny/tax-law/tax-sect-1105.html	Laws and Regulations
NY	https://govt.westlaw.com/nycrr/Document/I50f2201ecd1711dda432a117e6e0f345?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)	Laws and Regulations
NY	https://www.tax.ny.gov/pdf/publications/sales/pub840.pdf	Brochure
NY	https://www.tax.ny.gov/pdf/publications/sales/pub750.pdf	Brochure
NY	https://www.tax.ny.gov/pdf/memos/sales/m11_3s.pdf	Brochure
NY	https://www.tax.ny.gov/pdf/memos/sales/m06_6s.pdf	Brochure
NY	https://www.tax.ny.gov/pdf/tg_bulletins/sales/b11_525s.pdf	Brochure
NY	https://www.tax.ny.gov/pdf/tg_bulletins/sales/b14_103s.pdf	Brochure
NY	https://www.tax.ny.gov/pdf/tg_bulletins/sales/b11_160s.pdf	Brochure
NY	https://www.ny.gov/sites/ny.gov/files/atoms/files/GuideForTaxableandExemptPropertyandServices.pdf	Brochure
NC*	http://www.ncga.state.nc.us/gascripts/Statutes/StatutesTOC.pl?Chapter=0105	Laws and Regulations
NC*	http://www.dornc.com/practitioner/sales/bulletins/toc.html	Laws and Regulations
NC*	http://www.dornc.com/taxes/sales/foodnotice6-06.pdf	Brochure
ND*	http://law.justia.com/codes/north-dakota/2013/title-57/chapter-57-39.2	Laws and Regulations
ND*	https://www.nd.gov/tax/data/upfiles/media/gl-22062.pdf?20170414121353	Brochure

OH*	http://codes.ohio.gov/orc/5739	Laws and Regulations
OH*	http://www.tax.ohio.gov/portals/0/sales_and_use/information_releases/st200401.pdf	Brochure
OK*	http://law.justia.com/codes/oklahoma/2006/os68.html	Laws and Regulations
OK*	https://www.ok.gov/tax/documents/rule6509.pdf	Laws and Regulations
OK*	https://www.ou.edu/controller/fss/dwnload/SalesTax%20GeneralFAQs.pdf	Brochure
OR	http://landru.leg.state.or.us/ors/	Laws and Regulations
OR	http://arcweb.sos.state.or.us/pages/rules/oars_100/oar_150/150_tofc.html	Laws and Regulations
PA	http://www.pacode.com/secure/data/061/061toc.html	Laws and Regulations
PA	http://www.revenue.pa.gov/FormsandPublications/FormsforBusinesses/Documents/Sales-Use%20Tax/rev-717.pdf	Brochure
RI*	http://www.tax.ri.gov/regulations/FINAL%20REGS%202009/FoodandFoodIngredientsRegFinal%20v2%2002122010.pdf	Laws and Regulations
RI*	http://law.justia.com/codes/rhode-island/2010/title44/chapter44-18/	Laws and Regulations
RI*	http://www.tax.ri.gov/regulations/salestax/11-60.pdf	Laws and Regulations
RI*	http://www.tax.state.ri.us/streamlined/candy_soft_diet.php	Brochure
SC	http://www.scstatehouse.gov/code/t12c036.php	Laws and Regulations
SC	http://www.scstatehouse.gov/coderegs/c117.php	Laws and Regulations
SC	https://dor.sc.gov/resources-site/lawandpolicy/Advisory%20Opinions/RR06-5.pdf	Laws and Regulations
SC	https://dor.sc.gov/resources-site/publications/Publications/Sales%20and%20Use%20Tax%20Manual%202015%20Edition-Web.pdf	Brochure
SC	http://media.clemson.edu/procurement/2011SalesTaxSeminarManual_May.pdf	Brochure
SD*	http://legis.sd.gov/Statutes/Codified_Laws/DisplayStatute.aspx?Type=Statute&Statute=10-45	Laws and Regulations
SD*	http://dor.sd.gov/taxes/business_taxes/publications/pdfs/stguide2014.pdf	Brochure
SD*	http://dor.sd.gov/Publications/2013_Session_Presentations/PDFs/SummaryofStateSalesTaxExemptions0113.pdf	Brochure
TN*	http://www.lexisnexis.com/hottopics/tncode/	Laws and Regulations
TN*	https://www.tnumc.org/wp-content/uploads/2016/04/TN-Sales-Tax-booklet-2013.pdf	Brochure
TN*	https://revenue.support.tn.gov/hc/en-us/article_attachments/202401125/Notice__13-05.pdf	Brochure
TX	http://www.statutes.legis.state.tx.us/	Laws and Regulations
TX	https://comptroller.texas.gov/taxes/publications/96-280.pdf	Brochure
TX	https://comptroller.texas.gov/taxes/publications/94-155.pdf	Brochure
TX	https://comptroller.texas.gov/taxes/audit/docs/convenience-manual.pdf	Brochure
UT*	http://le.utah.gov/UtahCode/chapter.jsp?code=59	Laws and Regulations
UT*	http://www.tax.utah.gov/sales/food-rate	Brochure
UT*	http://www.tax.utah.gov/forms/pubs/pub-25.pdf	Brochure
VT*	http://www.leg.state.vt.us/statutes/sections.cfm?Title=32&Chapter=233	Laws and Regulations
VT*	http://www.state.vt.us/tax/pdf.word.excel/legal/regs/SU.finals.11012010.pdf	Laws and Regulations
VT*	http://tax.vermont.gov/sites/tax/files/documents/SalesTaxTaxable%26ExemptFS.pdf	Brochure
VA	http://law.lis.virginia.gov/vacode/title58.1/chapter6/	Laws and Regulations
VA	http://lis.virginia.gov/000/reg/TOC23010.HTM#C0210	Laws and Regulations
VA	https://www.tax.virginia.gov/laws-rules-decisions/rulings-tax-commissioner/05-78	Brochure
VA	https://www.tax.virginia.gov/sites/default/files/inline-files/TB%2013-5%20Nonprescription%20Drugs.pdf	Brochure
WA*	http://apps.leg.wa.gov/rcw/default.aspx?cite=82.08	Laws and Regulations
WA*	http://apps.leg.wa.gov/WAC/default.aspx?cite=458-20	Laws and Regulations
WA*	http://dor.wa.gov/Docs/Pubs/SpecialNotices/2012/sn_12_SoftDrinks.pdf	Brochure
WA*	http://dor.wa.gov/Docs/Pubs/SpecialNotices/2010/sn_10_WaterCandyGumTaxRepeal.pdf	Brochure
WA*	http://dor.wa.gov/content/aboutus/statisticsandreports/stats_ExemptionStudy.aspx	Brochure
WV*	http://www.legis.state.wv.us/wvcode/Code.cfm?chap=11&art=1	Laws and Regulations
WV*	http://tax.wv.gov/Documents/TSD/tsd300.pdf	Brochure
WV*	http://tax.wv.gov/Documents/TSD/tsd419.pdf	Brochure
WV*	http://tax.wv.gov/Documents/TSD/tsd420.pdf	Brochure
WI*	https://docs.legis.wisconsin.gov/statutes/statutes/77/III/51	Laws and Regulations
WI*	https://www.revenue.wi.gov/DOR%20Publications/pb220.pdf	Brochure
WY*	http://www.lexisnexis.com/hottopics/wystatutes/	Laws and Regulations
WY*	http://revenue.wyo.gov/home/rules-and-regulations-by-chapter	Laws and Regulations
WY*	http://revenue.wyo.gov/FoodExemption.pdf?attredirects=0	Brochure

* States indexed participate in the Streamlined Sales Tax Project (SSTP): http://www.streamlinedsalestax.org/

Online Appendix Table OA.3:
OLS and Instrumental Variables Estimates of the Effects of Sales Taxes on Prices and Quantity

Sample:	County Border Pair Sample		County Border Pair Sample **[Instrumental Variables Estimates]**	
Dependent variable:	Price	Quantity	Price	Quantity
	(1)	(2)	(3)	(4)
$\log(1+\tau_{mcs})$	0.986	-0.650	0.977	-0.594
	(0.016)	(0.084)	(0.017)	(0.093)
First-stage coefficient for $\log(1+\tau_{ms})$			1.011	
			(0.002)	
First stage F-statistic			413,454	
Specification:				
Store × Module fixed effects	y	y	y	y
Module × Year-Quarter fixed effects	y	y	y	y
Module × State × Year-Quarter fixed effects	y	y		
Module × Border Pair × Year-Quarter fixed effects			y	y
N (observations)	33,749,157	33,749,157	33,749,157	33,749,157
N (modules)	198	198	198	198
N (stores)	2,714	2,714	2,714	2,714
N (counties)	468	468	468	468
N (county-modules)	88,249	88,249	88,249	88,249

Notes: Columns (1) and (2) replicate the estimates of the OLS effects of sales taxes on quantity and prices reported in Table 2, column (2) (Panel A and Panel B). In columns (3) and (4), we report 2SLS estimates from instrumenting the county-level module-specific sales tax rates with the associated state-level sales tax rate. The independent variable is quarterly sales tax rate of module m in county c in state s and the instrument is is quarterly sales tax rate of module m in state s. One observation is a module in a store in a given quarter. Consumer prices $p(1+\tau)$ are tax inclusive. The Retail Scanner data is restricted to modules above the 80th percentile of the national distribution of sales. The sample is restricted to stores in border counties. Observations are weighted by the inverse of the number of times a store appears in the data. The regression model includes module-by-store and module-by-year-quarter-by-pair fixed effects, where pairs denote pairs of contiguous counties.

Online Appendix Table OA.4: Reduced-form OLS Estimates of the Effects of Chain Instrument on Prices and Quantity

Sample:	Full Sample						County Border Pair Sample					
Dependent variable:	Price			Quantity			Price			Quantity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Leave-me-out chain average log(*p*)	0.969			-1.165			0.964			-1.179		
	(0.002)			(0.026)			(0.003)			(0.026)		
Leave-county-out chain average log(*p*)		0.951			-1.148			0.951			-1.155	
		(0.003)			(0.026)			(0.003)			(0.026)	
Index based on UPC-level leave-me-out chain average log(p)			0.981			-1.062			0.975			-1.086
			(0.002)			(0.024)			(0.003)			(0.023)
Specification:												
Store × Module fixed effects	y	y	y	y	y	y	y	y	y	y	y	y
Module × Year-Quarter fixed effects	y	y	y	y	y	y	y	y	y	y	y	y
Module × State × Year-Quarter fixed effects	y	y	y	y	y	y						
Module × Border Pair × Year-Quarter fixed effects							y	y	y	y	y	y
N	53,895,446	53,890,260	53,892,855	53,895,446	53,890,260	53,892,855	33,749,157	33,739,222	33,746,705	33,749,157	33,739,222	33,746,705

Notes: This table reports estimates of the reduced-form effect of price instruments on consumer prices and quantity sold. One observation is a module in a store in a given quarter. Consumer prices are tax inclusive. The Retail Scanner data is restricted to modules above the 80th percentile of the national distribution of sales. All standard errors in this table are clustered at the state-module level and are reported in parentheses. In columns (1) to (6), the sample includes our full sample of stores and the regression model includes module-by-store and module-by-quarter-by-state fixed effects. In columns (7) to (12), the sample is restricted to stores in border counties. Observations are weighted by the inverse of the number of times a store appears in the data. The regression model includes module-by-store and module-by-quarter-by-pair fixed effects, where pairs denote pairs of contiguous counties. In columns (1), (4), (7) and (10) the independent variable is the chain average log price leaving store r out. In columns (2), (5), (8), and (11) the independent variable is the chain average log price leaving all stores in county c out. In remaining columns, the dependent variable is a regression-adjusted price index where each UPCs price is a leave-me-out chain average price.

Online Appendix Table OA.5: Robustness to Local Trends

Sample:	Full Sample		
	(1)	(2)	(3)
Panel A: Reduced-form OLS Estimates of the Effects of Sales Taxes on Consumer Prices and Quantity			
$d\log(p(1+\tau))/d\log(1+\tau)$	0.961	0.926	0.928
	(0.045)	(0.036)	(0.036)
$d\log(Q)/d\log(1+\tau)$	-0.668	-0.507	-0.336
	(0.185)	(0.165)	(0.164)
Panel B: 2SLS Estimates of the Price Elasticity of Demand			
$d\log(Q)/d\log(p)$	-1.202	-1.127	-1.064
	(0.027)	(0.030)	(0.030)
Panel C: "Plug-in" Estimate of the Tax Salience Parameter			
θ	0.575	0.507	0.376
Specification:			
Store × Module fixed effects	y	y	y
Module × Year-Quarter fixed effects	y	y	y
Module × State × Year-Quarter fixed effects	y		
Module × County × Linear time trend		y	
Module × Store × Linear time trend			y
N	53,895,446	53,902,268	53,902,268

Notes: This table reports estimates of the effects of sales taxes, of the price elasticity of demand, and of the tax salience parameter. In Panel A, the independent variable is quarterly sales tax rate of module m in county c in state s. One observation is a module in a store in a given quarter. Consumer prices $p(1+\tau)$ are tax inclusive. The Retail Scanner data is restricted to modules above the 80th percentile of the national distribution of sales. In Panel B, the reported coefficients are 2SLS estimates of the effect of consumer prices on quantity sold, where prices are instrumented with leave-self-out chain-level average prices. In Panel C, we report the estimate of the tax salience parameter. All standard errors in this table are clustered at the state-module level and are reported in parentheses. The sample includes our full sample of stores. In columns (1), the regression model includes module-by-store and module-by-quarter-by-state fixed effects. In column (2), the regression model includes module-by-store and module-by-quarter fixed effects, as well as county-module specific time trends. In column (3), the regression model includes module-by-store and module-by-quarter fixed effects, as well as store-module specific time trends.

Online Appendix Table OA.6: Reduced-form OLS Estimates of the Effects of Sales Taxes on Quantity and Expenditure

Sample:	Full Sample			County Border Pair Sample		
Dependent variable:	Quantity	Pre-tax price	Expenditure	Quantity	Pre-tax price	Expenditure
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Reduced-form OLS Estimates of the Effects of Sales Taxes						
$\log(1+\tau)_{mrn}$	-0.668	-0.0388	-0.741	-0.650	-0.014	-0.667
	(0.185)	(0.045)	(0.183)	(0.084)	(0.016)	(0.083)
Implied effect on quantity		-0.702			-0.653	
Panel B: Reduced-form OLS Estimates of the Effects of the Price Instrument						
z_{mrn}	-1.165	0.969	-0.351	-1.179	0.964	-0.359
	(0.026)	(0.002)	(0.0249)	(0.026)	(0.002)	(0.024)
Implied effect on quantity		-1.320			-1.323	
Panel C: "Plug-in" Estimate of the Tax Salience Parameter						
θ		0.552			0.491	
Specification:						
Store × Module fixed effects	y	y	y	y	y	y
Module × Year-Quarter fixed effects	y	y	y	y	y	y
Module × State × Year-Quarter fixed effects	y	y	y			
Module × Border Pair × Year-Quarter fixed effects				y	y	y
N (observations)	53,895,446	53,895,446	53,895,446	33,749,157	33,749,157	33,749,157
N (modules)	198	198	198	198	198	198
N (stores)	8,652	8,652	8,652	2,714	2,714	2,714
N (counties)	1,460	1,460	1,460	468	468	468
N (county-modules)	277,398	277,398	277,398	88,249	88,249	88,249

Notes: This table replicates the key parameters reported in Table 2, but using an alternative measure of quantity. Here, we report separately the effects of sales taxes (Panel A) and the effects of the price instrument (Panel B) on total expenditures on module m in store r at time n and on pre-tax prices. We then report the difference between the effect on expenditure and on prices as an alternative measure of the effect on quantity. Panel C reports the associated value of the tax salience parameter. The Retail Scanner data is restricted to modules above the 80th percentile of the national distribution of sales. All standard errors in this table are clustered at the state-module level and are reported in parentheses. In columns (1) to (3), the sample includes our full sample of stores and the regression model includes module-by-store and module-by-quarter-by-state fixed effects. In columns (4) to (6), the sample is restricted to stores in border counties. Observations are weighted by the inverse of the number of times a store appears in the data. The regression model includes module-by-store and module-by-quarter-by-pair fixed effects, where pairs denote pairs of contiguous counties.

Online Appendix Table OA.7: Calibration of Incidence and Marginal Excess Burden Formulas

[Table 3 Using County Border Pair Sample Estimates]

Tax salience parameter (θ):	Plug-in estimate of tax salience parameter, E[θ] = 0.528		Full salience, θ = 1	
Heterogeneity in θ:	$(1/p)$Var(θ) = 0	$(1/p)$Var(θ) = 0.25	No heterogeneity, $(1/p)$Var(θ) = 0	
Implied markup:	Baseline markup	Same markup from (1)	Same markup from (1)	Re-calibrate markup under θ = 1
	(1)	(2)	(3)	(4)
Panel A: Incidence and Marginal Excess Burden Formulas				
Incidence (I)				
General formula (imperfect salience, imperfect competition):	48.429	47.913	37.601	48.749
$(\rho_\tau(1+\tau) + (1-\theta)\tau\tilde{\varepsilon}_{D\tau} + \tau(1+\tau)\tilde{\varepsilon}_D(1/p)\text{Var}(\theta))\ /\ (\ (1-v/J)(1-\rho_\tau) + (v/J)\theta(1+\tau\rho_\tau)\ )$				
Incidence under perfect competition (for $0 < \theta \leq 1$)	∞	∞	∞	∞
Marginal Excess Burden ($d\tilde{W}/d\tau$)				
General formula (imperfect salience, imperfect competition):	-0.019	-0.029	-0.029	-0.026
$d\tilde{W}/d\tau = (\ (p-mc)/p + \theta\tau)\tilde{\varepsilon}_{D\tau} + \tau(1+\tau)\tilde{\varepsilon}_D(1/p)\text{Var}(\theta)$				
CLK / Taubinsky Rees-Jones formulas (perfect competition):	-0.012	-0.022	-0.022	
$d\tilde{W}/d\tau = \theta\tau\tilde{\varepsilon}_{D\tau} + \tau(1+\tau)\tilde{\varepsilon}_D(1/p)\text{Var}(\theta)$				
Panel B: Inputs and Intermediate Estimates Needed to Calibrate Formulas				
Inputs:				
Average tax rate, τ	0.034	0.034	0.034	0.034
Price Elasticity, $\tilde{\varepsilon}_D \equiv \partial\log(Q)/\partial\log(p)$	**-1.223**	**-1.223**	**-1.223**	**-1.223**
Tax Pass-Through, $\rho_\tau \equiv d\log(p(1+\tau))/d\log(1+\tau)$	**0.986**	**0.986**	**0.986**	**0.986**
Tax Elasticity, $\tilde{\varepsilon}_{D\tau} \equiv d\log(Q)/d\log(1+\tau)$	**-0.650**	**-0.650**	**-0.650**	**-0.650**
Tax Salience Parameter, θ				
Implied "Plug-In" Estimate of E[θ]	0.528	0.528		
Assuming full salience (E[θ] = 1)			1.00	1.00
$(1/p)$Var(θ)	0.00	0.25	0.00	0.00
Intermediate estimates:				
Implied estimate of $v/(J\epsilon_{ms})$	0.016	0.016		0.008
Implied markup $(p-mc)/p$	0.011	0.011		0.006
Implied estimate of v/J	0.013	0.013		0.007
(v/J = 0 is perfect competition, v/J = 1 is perfect collusion)				

Notes: This table reports calibrations of the tax incidence and marginal excess burden formulas. The results of these calibrations are shown in Panel A. Panel B presents the value of the input parameters taken from Table 2 column (2), as well as estimates of intermediate parameters. In column (1), the incidence and marginal excess burden formulas are implemented with no restrictions. In column (2) we allow for heterogeneity in salience parameter. In column (3), we use estimates of the markup based on the tax salience parameter reported in column (1), but assume full salience elsewhere in the formulas. In column (4), full salience is assumed throughout, including when calculating the markup.

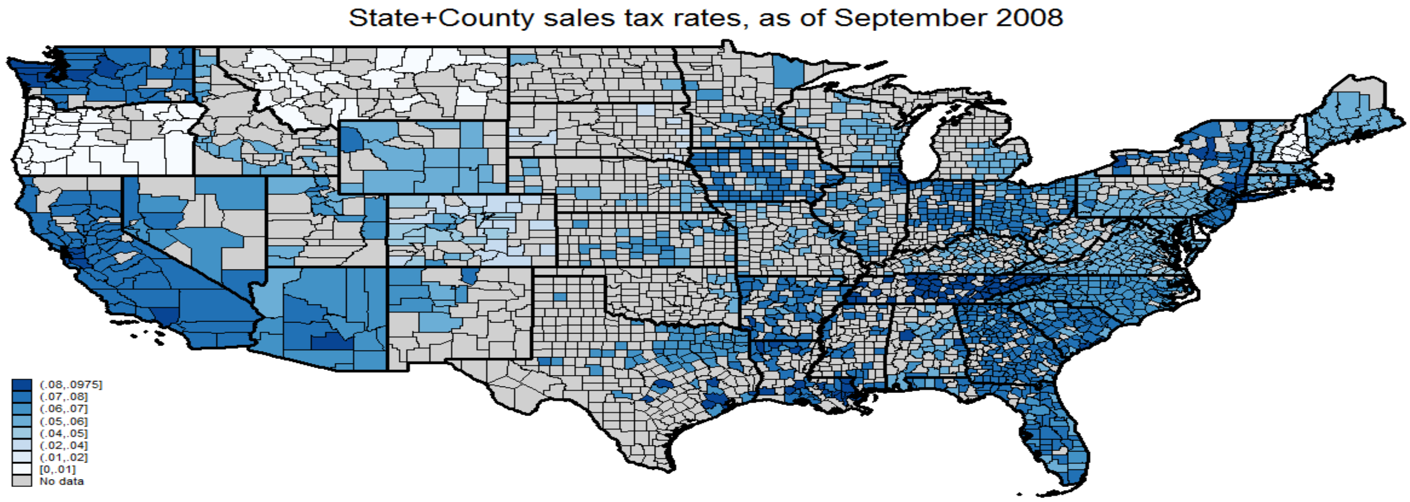
Online Appendix Table OA.8: Calibration of Incidence and Marginal Excess Burden Formulas

[Sensitivity of Table 3 to Alternative Values of Elasticity of Marginal Surplus]

Tax salience parameter (θ):	Plug-in estimate of tax salience parameter, E[θ] = 0.575				
Heterogeneity in θ:	$(1/p)\text{Var}(\theta) = 0$				
Implied markup:	Baseline markup				
	(1)	(2)	(3)	(4)	(5)
Panel A: Incidence and Marginal Excess Burden Formulas					
Incidence (I)					
General formula (imperfect salience, imperfect competition):	17.051	19.489	18.129	16.473	15.932
$(\rho_\tau(1+\tau) + (1-\theta)\tau\tilde{\epsilon}_{D\tau} + \tau(1+\tau)\tilde{\epsilon}_D(1/p)\text{Var}(\theta)) \,/\, ((1-v/J)(1-\rho_\tau) + (v/J)\theta(1+\tau\rho_\tau))$					
Incidence under perfect competition (for $0 < \theta \leq 1$)	∞	∞	∞	∞	∞
Marginal Excess Burden ($d\tilde{W}/d\tau$)					
General formula (imperfect salience, imperfect competition):	-0.033	-0.025	-0.029	-0.035	-0.037
$d\tilde{W}/d\tau = ((p-mc)/p + \theta\tau)\tilde{\epsilon}_{D\tau} + \tau(1+\tau)\tilde{\epsilon}_D(1/p)\text{Var}(\theta)$					
CLK / Taubinsky Rees-Jones formulas (perfect competition):	-0.014	-0.014	-0.014	-0.014	-0.014
$d\tilde{W}/d\tau = \theta\tau\tilde{\epsilon}_{D\tau} + \tau(1+\tau)\tilde{\epsilon}_D(1/p)\text{Var}(\theta)$					
Panel B: Inputs and Intermediate Estimates Needed to Calibrate Formulas					
Inputs:					
Average tax rate, τ	0.036	0.036	0.036	0.036	0.036
Price Elasticity, $\tilde{\epsilon}_D \equiv \partial\log(Q)/\partial\log(p)$	-1.202	-1.202	-1.202	-1.202	-1.202
Tax Pass-Through, $\rho_\tau \equiv d\log(p(1+\tau))/d\log(1+\tau)$	0.961	0.961	0.961	0.961	0.961
Tax Elasticity, $\tilde{\epsilon}_{D\tau} \equiv d\log(Q)/d\log(1+\tau)$	-0.668	-0.668	-0.668	-0.668	-0.668
Tax Salience Parameter, θ					
Implied "Plug-In" Estimate of E[θ]	0.575	0.575	0.575	0.575	0.575
Assuming full salience (E[θ] = 1)					
$(1/p)\text{Var}(\theta)$	0.00	0.00	0.00	0.00	0.00
Intermediate estimates:					
Implied estimate of $v/(J\epsilon_{ms})$	0.041	0.052	0.046	0.037	0.034
ϵ_{ms} (assume $1/\epsilon_D$ in col (1), sensitivity analysis in (2)-(5))	0.832	**0.400**	**0.600**	**1.000**	**1.200**
Implied markup $(p-mc)/p$, which equals $v/(J\epsilon_D)$	0.028	0.017	0.023	0.031	0.034
Implied estimate of v/J	0.034	0.021	0.028	0.037	0.041
($v/J = 0$ is perfect competition, $v/J = 1$ is perfect collusion)					

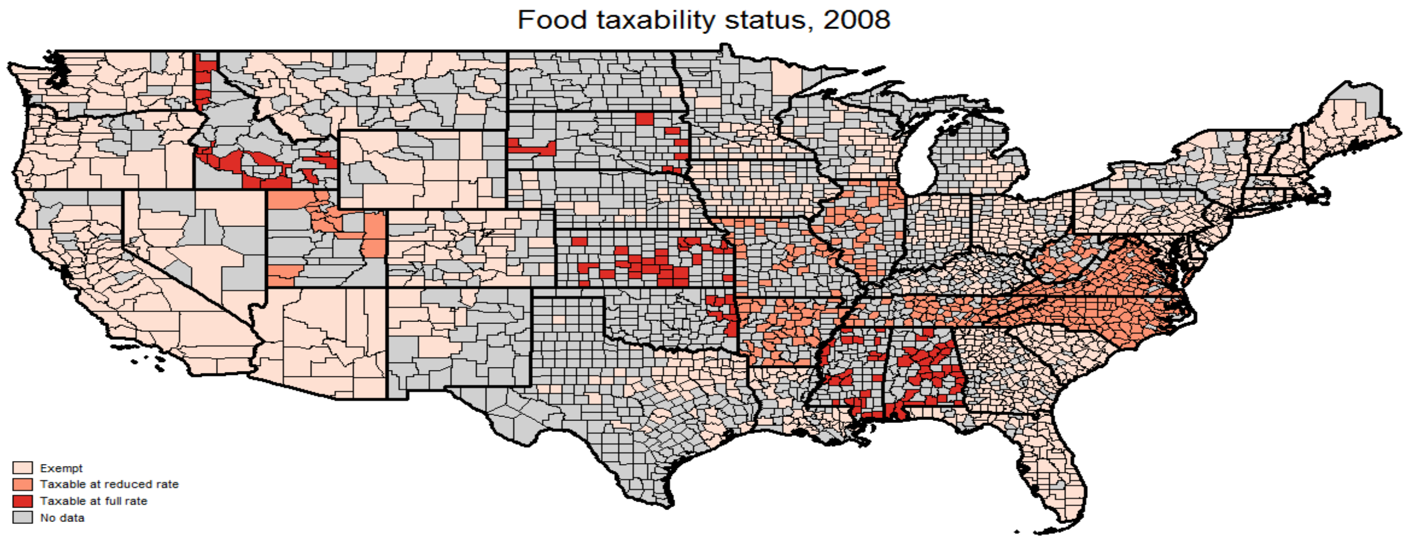
Notes: This table reports calibrations of the tax incidence and marginal excess burden formulas. The results of these calibrations are shown in Panel A. Panel B presents the value of the input parameters taken from Table 2 column (1), as well as estimates of intermediate parameters. In column (1), the calibration assumes a specific relationship between the demand elasticity and the elasticity of marginal surplus (ϵ_{ms}), while in the remaining columns the calibration assumes alternative values for ϵ_{ms}.

Online Appendix Figure OA.1: Map of Cross-Sectional Variation in Sales Tax Rates



Notes: 'No data' indicates counties for which no grocery store sales were recorded in Nielsen's Retail Scanner data in 2008.

Online Appendix Figure OA.2: Map of Cross-Sectional Variation in Sales Tax Exemption Status of Food Products



Notes: 'No data' indicates counties for which no grocery store sales were recorded in Nielsen's Retail Scanner data in 2008.